General Notes.

MINERALOGY.[1]

Crystallization of Enargite.—Pirsson[2] has studied enargite from two new Colorado localities, viz., the Ida Mine, Summit District, and the National Belle Mine, Red Mountain. At the former locality the mineral is deposited in cavities left after the kaolinization of feldspar phenocrysts in porphyry. These crystals are tabular parallel to $\infty P\bar{\infty}$, and are bounded by the forms $\infty P\bar{\infty}$, oP, ∞P, and $\infty P2$. At the latter locality two types of crystals are found. One of these is in thick, striated prisms bounded by the same forms as the Ida Mine crystals and sometimes in addition $P\breve{\infty}$, $P\bar{\infty}$, $\infty P\breve{2}$, and another brachydome. The second type of crystals from this locality is tabular parallel to the base and shows hemimorphic development. The forms observed on this type are oP, $\infty P\bar{\infty}$, ∞P, $\infty P3$, $P\breve{\infty}$, $\frac{3}{4}P3$.

Crystallization of Scolecite and Meta-scolecite.—Rinne[3] has investigated crystals of scolecite from Iceland and shown that the mineral crystallizes in the rare inclined-faced hemihedral division of the monoclinic system. This fact was developed by etching and by study of the pyroelectric properties. The front faces of the prism have different etched figures from the rear faces, while in twinned crystals with the twinning plane the ortho-pinacoid, front and rear faces of the prism have the same figures. In simple individuals the front and rear faces are pyroelectrically positive and negative poles respectively. In twinned crystals all prism faces are positive and a negative zone follows the twinning line on $\infty P\breve{\infty}$ with neutral bands on either side.

When crystals of the mineral are heated much above 120° C they become cloudy, and the crystal structures seems at first sight to be lost, but by brightening up in oil it is found that a molecular rearrangement has taken place. This new mineral Rinne calls meta-scolecite. The inclined-faced hemihedrism of the monoclinic system is retained, but a remarkable revolution of the molecular groups through

[1]Edited by Dr. Wm. H. Hobbs, University of Wisconsin, Madison, Wis.

[2]Am. Jour. Sci., (3) xlvii, pp. 212–215.

[3]Neues Jahrb. f. Mineral., etc., 1894, II, pp. 51–68.

an angle of 90° about the c axis has taken place. The ortho-pinacoid has become the clino-pinacoid and vice-versa. The twinning plane of twinned crystals has undergone the same revolution. By heating crystals beyond the temperature required for producing the first meta-scolecite, the double refraction of the substance steadily decreases and the symmetry approaches more and more closely to the orthorhombic. Below red heat the structure breaks down. As scolecite possesses three molecules of water of crystallization, Rinne suggests that the first meta-scolecite contains two, the second one molecule of crystal water, the crystal structure being lost when all the water has been removed.

Crystallization of Herderite.—Penfield[4] has made a study of herderite from the known localities as well as from a newly discovered locality at Paris, Me. The herderite from the latter locality as well as that from Hebron, contains scarcely any fluorine, its place being taken by hydroxyl, and the author proposes for it the name hydro-herderite. As the Stoneham herderite contains hydroxyl and fluorine in the proportions of 3 : 2, the one apparently replacing the other isomorphically, the name hydro-fluor-herderite is proposed for such intermediate varieties between theoretical fluor-herderite and hydro-herderite. In the crystallographic study the fact is brought out that the mineral is monoclinic instead of orthorhombic as has been supposed. This is proven not alone on Paris specimens but on specimens from the other localities, which were reexamined for this purpose. The crystals, however, approach closely to the orthorhombic system, the hydro- fluor-herderite being more nearly orthorhombic than the hydo-herderite, the substitution of fluorine for hydroxyl tending to increase the crystallographical axial angle and to shorten the clino-diagonal. It likewise diminishes the mean index of refraction and the optical angle.

Composition and Related Physical Properties of Topaz.—Jannatsch and Locke[5] have shown that topaz contains water of constitution, from a chemical study of specimens from San Louis Potosi, Ilmen Mts., Schneckenstein, and Brazil. Penfield and Minor[6] have independently established the same fact by a larger number of analyses, and shown how this greatly simplifies the formula of the mineral on

[4]Am. Jour. Sci., (3) xlvii, pp. 329–339.
[5]Am. Jour. Sci., (3) xlvii, pp. 386-387.
[6]Ibidem, pp. 387–396.

the assumption that hydroxyl and fluorine are isomorphous. Their results show that whereas the ratio $SiO_2 : Al_2O_3 :$ F varies from 1 : 1 : 1.50 to 1 : 1 : 1.84, the ratio $SiO_2 : Al_2O_3 :$ (F. OH) is constant and 1 : 1 : 2, so the formula of topaz becomes (Al [F. OH] $)_2$ SiO_4 or (Al [F. OH$]_2$) Al SiO_4. Their study of the physical properties of the mineral establishes a definite relation between them and the per cents of fluorine and water present, clearly indicating the isomorphous character of the fluorine and hydroxyl. The hydro-topaz has the smaller optical angle and the smaller specific gravity. The same fact is brought out by the determined values for α, β, and γ, and by exact measurements of interfacial angles. The optical anomalies of some Brazilian crystals are explained by zonal growth of topazes of different composition.

Composition of Chondrodite, Humite, and Clinohumite.—Penfield and Howe[7] have undertaken the study of the composition of the members of the humite group with the result not only of bringing order out of chaos, but also of establishing the fact that chondrodite, humite, and clinohumite constitute an homologous series both in a chemical and in a crystallographical sense. Sjögren has assumed that fluorine and hydroxyl are isomorphous, and derived new formulas for the members of this series, but as the authors point out the older analyses which Sjögren utilized are low as regards water, and Sjögren neglected to take into account the replacement of magnesia by ferrous iron and the consequent lowering of the silica percentage. The formulas derived by the authors, reckoning ferrous iron as magnesia, are as follows:

Chondrodite	Mg_3 (Mg [F. OH]$)_2$ $(SiO_4)_2$
Humite	Mg_5 (Mg [F. OH]$)_2$ $(SiO_4)_3$
Clinohumite	Mg_7 (Mg [F. OH]$)_2$ $(SiO_4)_4$

The common difference of this homologous series is a molecule of chrysolite, Mg_2 SiO_4. As shown by Sacchi and vom Rath, if the 'c' axis of crystals of chondrodite be divided by 5, that of humite by 7, and that of clinohumite by 9, the axial ratios of the three minerals become practically identical. Now these divisors, 5, 7, and 9, are the same as the number of magnesia atoms in the formulas of the corresponding minerals. A most interesting relation is thus brought out connecting the crystal forms and chemical compositions of the members of this group. The authors think it probable that other members of this series will be discovered, such as a mineral of the composition Mg (Mg [F. OH]$)_2$

[7]Am. Jour. Sci., (3) xlvii, pp. 188–206.

SiO_4. This compound should have either orthorhombic or monoclinic symmetry, with β equal to 90° and an axial ratio a : b : c=1.086 : 1 : 1.887.

Leucite from New Jersey.—Kemp[8] argues for the presence of partially decomposed leucites in a dyke rock at Rudeville, Sussex Co., N. J., from a micro-chemical test indicating the presence of potassium, and from remains of leucite twinning, in spheroids now largely made up of analcite, calcite, feldspar, and other supposed secondary products.

Variscite from Utah.—Packard[9] gives an analysis of a specimen of compact or cryptocrystalline variscite from a quartz vein near Lewiston, Utah. The analysis is as follows:

H_2O 22.95 P_2O_5 44.40 Al_2O_3 (By difference) 32.65.

Utilization of Auerbach Calcite for Nicols.—An attempt has been made[10] to utilize the clear calcite from Auerbach on the Bergstrasse, Germany, for Nicol's prisms. Four ordinary Nicols with inclined end faces were prepared by Schmidt & Haensch of Berlin, and although these are equal to the medium quality Nicols prepared from Iceland spar in the matter of extinction, they nevertheless contain inclusions, air bubbles, etc., which are visible even to the naked eye. Dr. Hoffman, the owner of the Auerbach quarries, still hopes to secure material pure enough to take the place of Iceland spar. The material already tested will suffice for technical purposes.

Crystallization of Willemite.—Willemite has been supposed to have rhombohedral tetartohedral symmetry from the similarity of its rhombohedral angles to those of phenacite. Penfield[11] studies crystals from the Merritt Mine, N. M., Sedalia Mine, Salida, Col., and Franklin, N. J. In the specimens from the first and last mentioned localities, rhombohedrons of the second and third orders were observed and measured, showing that the system is what has been supposed. On the crystals from the Merritt Mine the second and third order rhombohedrons are $\frac{\frac{2}{3}\,P\,2}{4}\,\frac{l}{r}$ and $\frac{\frac{3}{5}\,P\,\frac{3}{2}}{4}\,\frac{r}{l}$ respectively. One of the types from the Franklin Mines is terminated by a third order rhombohedron $\frac{3\,P\,\frac{3}{2}}{4}\,\frac{l}{r}$ alone, thus resembling the phenacite crystals from Mte. Antero, Col.

[8]Am. Jour. Sci., (3) xlvii, pp. 339–340.

[9]Am. Jour. Sci., (3) xlvii, pp. 297–298.

[10]Zeitschrift für Instrumentenkunde, 14te Jahrgang (1894), p. 54.

[11]Am. Jour. Sci., (3), xlvii, pp. 305–309.

The author shows that the cleavage of willemite is like that of troostite, indistinct cleavages parallel to both the base and prism being made out in willemite.

Composition of Staurolite and Arrangement of its Inclusions.—Exceptionally pure material for analysis was obtained by Penfield and Pratt[12] from St. Gothard, Switz., Windham, Me., Lisbon, N. H., and near Burnsville, N. C. A powder of uniform specific gravity was obtained in each case by the use of fused silver nitrate as a separating fluid in a specially constructed apparatus, the heavier and lighter portions of the powder being in this way removed. Reckoning MnO and MgO as FeO, and Fe_2O_3 as Al_2O_3, the four specimens yield results that agree well and indicate clearly that staurolite has the empirical formula $H\ Al_5\ Fe\ Si_2O_{13}$ as already suggested by Groth. The silica alone does not agree closely with this formula, being in every case about one per cent too high, and the authors think that this is due to the presence of inclusions of quartz too minute to be separated from the powder. Carbonaceous inclusions are in the staurolite from Lisbon, N. H., arranged in the same manner as in chiastolite crystals. The explanation of the authors is that the crystals of staurolite in growing in a solid rock, find it difficult to exclude foreign substances, the tendency to include them being greatest at the crystal edge and greatest where the interfacial angle is largest.

Determination of Quartz and the Feldspars in thin Section.—Sometime since Becke described a method of distinguishing quartz from feldspar by treatment with hydrochloric acid and subsequently tinting. He now[13] applies the same method to distinguish orthoclase from plagioclase and to determine the particular plagioclase species. Orthoclase is less affected by acid than plagioclase, and the soda rich plagioclases are less affected than the lime rich species. In rocks containing quartz, orthoclase and plagioclase, the slide is etched until by tinting the plagioclase shows an intense color. The orthoclase will then be faintly tinted and the quartz entirely unaffected.

Continuing his study Becke[14] has devised methods for the same determinations based on differences of refractive index. The first method consists in the examination of a perpendicular contact plane between

[12]Am. Jour. Sci., (3), xlvii, pp. 81-89.

[13]Tscherm. min. u. petrog. Mitth., xii, Heft 3, p. 2 (Notizen).

[14]Sitzungsber. d. k. Akad. d. Wissensch. i. Wien, Math. Naturw. Classe, Bd. II, Abth. I, pp. 358–376, July, 1893.

the two minerals with a cone of illumination of small angle. When properly focused, this contact appears as a sharp line. On raising the tube of the instrument, the focus is disturbed and a light band appears on the side of the contact toward the more refractive mineral, which band widens and finally fades out as the tube is raised higher. If, on the other hand, the tube be lowered, the same phenomena appear on the other side of the contact. The best results are obtained with the use of high powers and with a cone of illumination of small angle. Becke recommends the use of the *Irisblende* furnished with the newer instruments of Fuess. I have obtained good results with a small Voigt and Hochgesang instrument by removing the weak convex lens which covers the polarizer. Becke's *Schlierenmethode* makes use of inclined illumination, which is obtained with the *Irisblende* or with Abbe's *Beleuchtungsapparat.* With inclined illumination, that side of a section of strongly refracting mineral toward the direction from which the light comes, shows a light band against the less strongly refracting mineral surrounding it, while the opposite side shows a dark band. The author states that this method suffices to determine orthoclase, quartz, and a plagioclase when they are present together in a holocrystalline rock, but suggests that it be supplemented by the *Färbung* method. The method of determining the species of plagioclase depends on the comparison of the double refraction of the feldspar with that of quartz sections. By making per cents of *An* the abscissæ, and indices of refraction the ordinates, curves are obtained for α, β and γ within the feldspar series. These curves are intersected by the horizontal curves of ω and ε in quartz. If now α' and γ' be the less and the greater values respectively of the refraction for the two principal directions in any section of plagioclase, α' being between α and β and γ' between β and γ, the curves obtained indicate the following relations:

	Parallel Position		Crossed Position		Composition.
I	$\omega > \alpha'$	$\varepsilon > \gamma'$	$\omega > \gamma'$	$\varepsilon > \alpha'$	Ab —$Ab_8\,An_1$
II	$\omega > \alpha'$	$\varepsilon > \gamma'$	$\omega = \gamma'$.	$\varepsilon > \alpha'$	$Ab_8\,An_1$—Ab_3An_1
III	$\omega = \alpha'$	$\varepsilon > \gamma'$	$\omega < \gamma'$	$\varepsilon > \alpha'$	$Ab_3\,An_1$—Ab_2An_1
IV	$\omega < \alpha'$	$\varepsilon = \gamma'$	$\omega < \gamma'$	$\varepsilon > \alpha'$	Ab_2 An—$Ab_3\,An_2$
V	$\omega < \alpha'$	$\varepsilon < \gamma'$	$\omega < \gamma'$	$\varepsilon = \alpha'$	$Ab_3\,An_2$—Ab An_1
VI	$\omega < \alpha'$	$\varepsilon < \gamma$	$\omega < \gamma'$	$\varepsilon < \alpha'$	$Ab_1\,An_1$—An_1

It is seen that these subdivisions of the plagioclases correspond in a general way to the earlier one of Tschermak, I being albite, II and III oligoclase, IV and V andesine, while VI includes labradorite, bytounite and anorthite. As Tschermak's later and more equable subdivi-

sion of the series has not been generally accepted, Becke thinks the harmony between his natural table and the older scheme of Tschermak a reason for retaining the original classification. The practical method of utilizing the results in his table, consists in finding contiguous sections of quartz and plagioclase which extinguish nearly parallel to one another. By means of the quartz wedge it is then determined whether the double refraction of these sections is of the same or of opposite sense. If the former, they are said to have parallel position and will indicate some of the relations of the first column of the table, and, if the latter, they have crossed position and their relations will correspond to something in the second column of the table. The quartz section always yields ω and a value varying but little from ε.

This method applies only to holocrystalline rocks which contain quartz, but it is a discovery of much importance which will doubtless be of much service in the study of the crystalline schists. The author has applied the method to the determination of the feldspar in many rocks of the Rosenbusch collection of B. Stürz, and printed his list of determinations. An excellent photogram also accompanies the paper.

Fluid Enclosures in Sicilian Gypsum.—The Cianciana gypsum contains cavities filled with liquid, some of which are 3 cm. in extent. Sjögren[15] has analyzed the liquid with the following results:

K_2O	Na_2O	CaO	MgO	Cl	SO_3	Total	O deducted for Cl_2	Cor. Total
2.1	40.9	4.1	3.9	44.9	14.1	110.0	10.1	99.9

Corresponding to

K_2SO_4	Na_2SO_4	$CaSO_4$	NaCl	$MgCl_2$	Total
3.7	11.4	9.7	66.2	9.0	100.0

The saline constituents were 4.023 per cent of the solution. This fluid is a fossil water of Miocene age, and differs from ocean water chiefly by containing a greater percentage of sulphates. It agrees fairly well with the water of some sulphur springs. The author thinks that the quantity of sulphates present in the water of the enclosure shows that the gypsum and sulphnr cannot have been derived from a lagoon of sea water in which organic matters have reduced sulphur from the contained sulphates. Whether they are the product of sulphur springs or of emanations of H_2S in a lagoon of sea water in which sulphur has been deposited and sulphates formed by action of SO_3 on marls, the author is unable to determine.

[15]Bull. Geol. Inst. Upsala, I, (1893), No. 2, pp. 1–7.

New Sulphostannate from Bolivia.—In 1893 Penfield described a new isometric germanium mineral from Bolivia, which had the formula $Ag_8\ Ge\ S_6$, and which he named canfieldite. This he showed to be identical chemically with Winkler's Freiberg mineral argyrodite, which that chemist had given the formula $Ag_6\ Ge\ S_5$ and which Wei‹›ach had considered monoclinic. Weisbach has since found that his earlier determination of the symmetry was incorrect, it being isometric tetrahedral and identical with the Bolivian mineral which should hence bear the name argyrodite. Penfield now transfers the name canfieldite[16] to a new sulphostannate of silver from La Paz, Bolivia, having isometric symmetry. A part of the tin is replaced by Germanium. The formula of the mineral is $Ag_8\ (Sn\ Ge)\ S_6$, argyrodite being $Ag_8\ Ge\ S_6$. The two minerals have similar physical properties, and are evidently isomorphous.

Allanite from Franklin Furnace.—Eakle[17] has made a crystallographical study of the allanite from the Trotter Mine, Franklin Furnace, N. J. The crystals occur in a granite dike associated with zinc ores. They are variable in habit and exhibit in all fourteen forms, none of which are, however, new to the species. The same author describes the tourmalines[18] from Rudeville and Franklin Furnace.

Miscellaneous.—Model[19] has found molybdenite and molybdite in the serpentine of the Rothenkopf, Zillerthal—. Carnot[20] has made an examination of the composition of wavellite and turquoise. In four analyses of wavellite from Cork, Ireland; Clomnel, Ireland; "Chester, Etats unis" (probably from Pennsylvania); and Garland, Arkansas, the fluorine was found to be 1.90, 2.79, 2.09 and 1.81 per cents respectively. Carnot proposes for the mineral the formula $2\ (P_2O_5\ Al_2O_3)+Al_2\ (O_3F_6)+13\ H_2O$, but in the light of the recent work of Penfield, it seems more probable that part at least of the water present, is water of constitution, and that the fluorine replaces hydroxyl and not oxygen. In two specimens of turquoise of mineral origin (from Persia and Nevada respectively) no fluorine was found. Two specimens of occidental turquoise (odontolite) yielded each over three per cent of fluorine. The entrance of fluorine into odontolite during its derivation from fossil teeth, the author was led to expect from his study of the composition of fossil bones of the different geological ages.

[16]Am. Jour. Sci., [3], xlvii, pp. 451–4.
[17]Trans. N. Y. Acad. Sci., xiii, p. 102; also Am. Jour. Sci., [3] xlvii, pp. 436–8.
[18]Am. Jour. Sci., [3], xlvii, p. 439.
[19]Tscherm. min. u. petrog. Mitth., xiii, p. 532.
[20]Comptes rendus. cxviii, pp. 995–8.